FEDERAL
AN ESTERLINE COMPANY

INSTRUCTIONS

SERIES "432" AMPLIFIERS

MODELS EAS-2347 thru EAS-2354

Federal Products Corporation, 1144 Eddy Street, P.O. Box 9400, Providence, Rhode Island 02940-9400 U.S.A.
Telephone: 401-781-9300 Telex: 927623 FEDGAGE PVD Cable: Federal Providence

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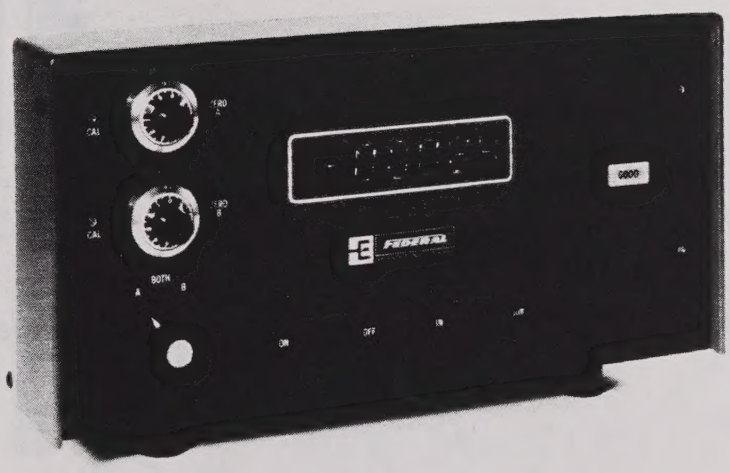
Note: Federal Products reserves the right to change product design and specifications without notice.

Section 1: Introduction



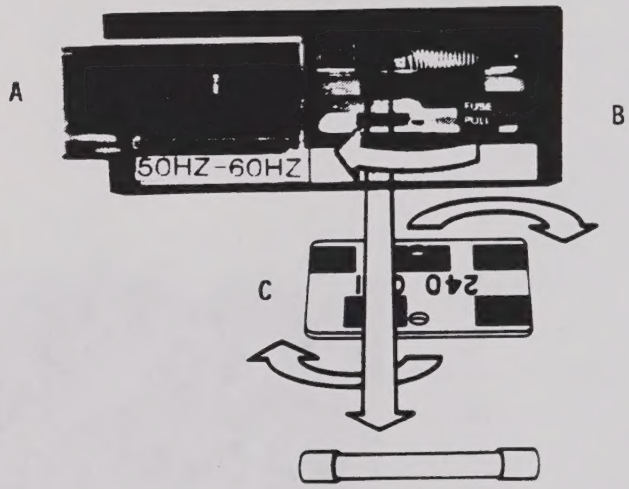
Description

Series "432" Amplifiers can be used with any Federal Products "Multi-Choice" electronic gage head(s). These instructions describe how to set up any regular amplifier/gage head system and verify and adjust its calibration.

All Series "432" Amplifiers are Inch/Metric. When calibrated in either system, calibration is automatically achieved in the other.

Power On

Before operating unit, be sure proper power conditions exist: Voltage has been pre-set according to your specifications; however, should it be necessary to change voltage, the following procedure applies:



A. Remove Power Cable and slide clear cover over to left.

B. Draw fuse extractor to left and remove fuse.

C. Slide out circuit board and rotate until desired voltage is shown on left side.

Replace circuit board and fuse. Slide clear cover to right and re-connect power cable.

Push Power Switch on Rear Panel to the "On" position.

Section 2. Setup

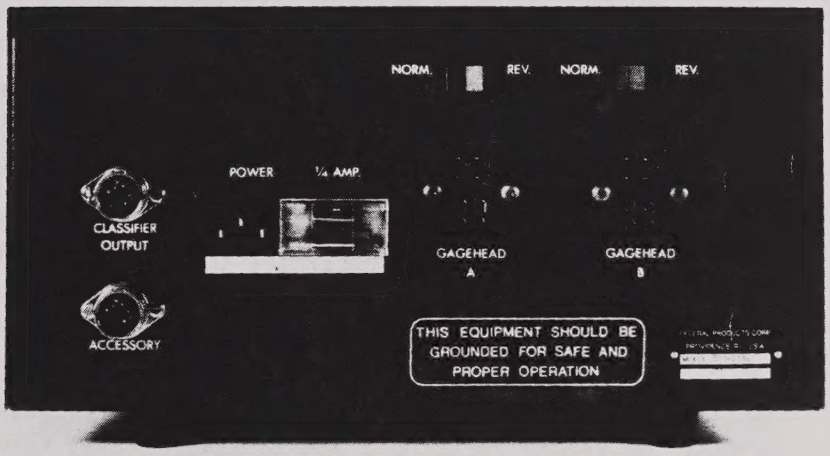
Tolerance Limits

Four models are equipped with adjustable limits which cause red, green and yellow limit lights to function. With Amplifier on, set limits as follows:

1. If maximum limit spread is within ±.0025", you can unplug the gage head(s) involved and set the meter to each limit using the Zero Knob. If limit spread exceeds ±.0025", you will need to displace the gage head contact enough so that the limit you are setting is within Zero Knob range. Using appropriate method, set meter to read exact low tolerance limit value, for example, -.00025".

2. Use a small screwdriver to adjust the potentiometer, located to the the right of the UNDER light, until the light goes out and the GOOD light comes on. Check setting by moving meter reading back slightly towards "zero", then slowly towards -.00025". As the meter passes .00025", UNDER light should come on. Fine tune potentiometer if necessary.

3. Use Zero Knob to make meter read exact upper tolerance limit, for example, +.00025". Repeat procedure in step 2, except use OVER limit potentiometer to make OVER light go on when meter reading exceeds +.00025".



Series "432" Amplifiers
Rear Panel

Single Head Gaging

1. Plug gage head connector into receptacle on rear of amplifier.

2. Set amplifier controls:

Zero control at mid-range (#5 in the window).
Range switch (analog models only) to desired range.
Head selector to letter of head being set (dual-head models only).
Inch-Metric switch to appropriate system
Off-On Switch to On
Normal/Reverse switch (above gage head receptacle) to position that gives plus reading when dimension being checked increases. (set both switches on dual-head models).

3. Put a nominal (mean size) master in gaging position. The meter should read within ±.001" of "zero". If it does not, loosen gage head mounting and move the gage head in or out until meter reads ±.001" of "zero", with gage head mounting locked up.

4. Use Zero Contol to make meter read exact "zero" (or exact known deviaton of the master from nominal size).

Dual Head Gaging - Differential Mode

The dual head amplfiers can integrate the outputs from two gage heads and display the algebraic sum of the two signals as a single reading. This mode is commonly used for gaging a diameter (or thickness) not positively located in space.

1. With gage heads removed, set both Zero Controls to mid-range.

2. Connect both gage heads to their respective sockets at the rear of the amplifier.

3. Put both gage head polarity switches, "A" and "B", in the "Normal" position. This will provide "plus" input.

4. Place the gage head Selection Switch in the "A" position.

5. Using a setting master or qualified workpiece, position gage head "A" to produce a reading within ±.001" of "zero". Then lock the gage head in this position.

6. Place the gage head select switch in "Both" position.

7. Adjust the position of gage head "B" until the meter again reads within ±.001" of "zero". Then, lock the gage head in this position. Use either Zero control to bring meter reading to exact "zero".

As the part is rotated during gaging, any lack of concentricity between the large and small diameters is cancelled by equal but opposite output from the gage heads and a true reading of diameter is presented.

To obtain an indication of eccentricity, place the gage head selection switch in the "A" position. Now the reading will be the radial runout at gage head "A". The same can be done with gage head "B".

Note: Sometimes the part's shape or the gaging fixture design requires a means of contacting the part with something such as a lever which reverses the direction of the gage head action. Then, variations in size etc. can be displayed in the normal direction by placing both gage head input switches in the reverse position. This will provide a "minus" input.

Dual Head Gaging - Angle Conformity or Rate-of-Taper Mode

1. With gage heads removed, set both Zero Controls to mid-range.

2. Connect both gage heads to the amplifier.

3. Put the Gage Head Polarity Switch for Head "A" in the Normal position for "plus" input. Put the switch for Head "B" in the Reverse Position for "minus" input.

4. Place the Gage Head Select Switch on "A".

5. Using a master or qualified workpiece, position gage head "A" to produce a reading within ± .001" of "zero". Then, lock gage head in this position. Use "A" Zero Control to position meter exatly on "zero".

6. Place the Gage Head Select Switch in the BOTH position.

7. Adjust the position of gage head "B" until the reading is again within ±.001" of "zero". Then lock the gage head in this position. Use either Zero Control to set the meter exactly on "zero".

Changes in taper will be shown. Variations in size that do not affect taper are cancelled out.

Section 3. Calibration

On analog models, with power off, check alignment of hand with dial "zero". If not exactly on "zero", adjust screw in line with pivot point of hand until alignment is exactly on "zero".

Turn power on and allow the amplifier to be in operation for a reasonable amount of time for complete stabilization.

Single Head Models

1. Secure the gage head in suitable fixture. Set the amplifier controls as follows:

Mode Switch	Inch
Scale Selector Switch (analog meters only)	Longest Range
Polarity Switch (on back panel)	Norm.
Electrical Zeroing Control	No. 5 in window

2. Select three gage blocks which differ in size by .010". Place the middle size block in position and adjust the position of gage head "B" mechanically so that the meter reads as closely as possible to "zero". Adjust Electrical Zeroing, if necessary, to achieve precise alignment. Remove and reposition gage block to check for proper repeat reading.

3. Substitute the +.010" gage block and observe any deviation from a +.010" reading on the meter. If there is a deviation, use CAL Screw to reduce the deviation by 1/2 its value.

4. Substitute the -.010" gage block and observe any deviation from -.010" reading. If there is one, use Zero potentiometer to reduce the deviation by 1/2 its value.

5. Repeat steps 3 and 4 until end of range errors are 4/5 graduation or less on analog meters or ±1 count of least digit on digital meters.

6. Substitute the "zero" gage block and observe any deviation from an exact "zero" reading. If reading is more than 4/5 a graduation on analog meter, or more than ±1 count of least digit on digital display, reset meter to "zero" with Zero Potentiometer and repeat steps 3, 4 and 6.

7. Set the Polarity Switch in the Reverse position. Fine tune "zero" setting with Zero Knob (if necessary)

and repeat steps 2 and 3, except do NOT adjust CAL Screw or Zero Knob. Each reading should match the reading obtained in step 3 within the calibration accuracy, but at the opposite ends of the scale.

Dual Head Models

The checking and adjustment of these amplifiers and the balancing of gage head outputs can be performed in one series of operations. It requires a fixturing setup that permits the contacts of both gage heads to engage the same gage block simultaneously. Point of contact should be as close together as possible.

1. Set the amplifier control as follows:*

Mode Switch	Inch
Scale Selector Switch (analog meters only)	Longest Range
Polarity Switches (on back panel)	Norm.
Electrical Zeroing Controls	No. 5 in window
Gage Head Selector Switch	"B"

*Note: Be sure <u>both</u> Polarity Switches and <u>both</u> Electrical Zeroing Controls are set as stated.

2. Select three gage blocks which differ in size by .010". Place the middle size block in position and adjust gage head "B" mechanically so that the meter reads as closely as possible to "zero". Adjust the electrical Zeroing Control for Gage Head "B" if necessary, to achieve precise alignment. Remove the gage block and reinsert to check for the proper repeat reading.

3. Substitute the +.010" gage block and observe any deviation from +.010" reading on the meter. If there is a deviation, use CAL B screw to reduce the deviation by 1/2 its value.

4. Substitute the -.010" gage block and observe any deviation from a -.010" reading. If there is one, use Zero B potentiometer to reduce the deviation by 1/2 its value.

5. Repeat steps 3 and 4 until end-of-range errors are 4/5 graduation or less on analog meters or ±1 count of least digit on digital meters.

6. Substitute the "zero" gage block and observe any deviation from an exact "zero" reading. If reading is more than 4/5 a graduation on analog meter, or more

than ±1 count of least digit on digital meter, reset meter to "zero" with Zero Potentiometer and repeat steps 3, 4 and 6.

7. Reverse "B" Head polarity switch, fine tune "zero" setting with Zero Knob (if necessary) and repeat steps 2, 3 and 4, except do not make any adjustments. Readings should be same as they were at end of step 6 except with "plus" and "minus" at opposite sides of "zero".

8. Place gage head "A" in position. Turn Selector Switch to the "A" position and make adjustments as in Step 2.

9. Follow the same procedure as in Steps 2 through 7 except use CAL A and Zero A Potentiometers.

10. Turn the Range Selector Switch to the shortest range and use the Electrical Zeroing Controls to set meter precisely to "zero" as the Head Selector Switch is placed alternately in the "A" and "B" position.

11. For balancing, set one polarity switch to NORMAL and one to REVERSE. Check "zero" setting for each head and fine tune, if necessary. Then turn the Head Selector Switch to the BOTH position. The Scale Selector Switch should be set on the shortest range. Place the +.010" gage block beneath the contacts of both gage heads. The meter should read within 5 graduations of "zero" for analog meters or ±2 counts of least digit on digital meters. A similar reading should be obtained with the -.010" gage block in place. This indicates a balancing accuracy to within 0.25% at maximum displacement. If the balancing accuracy is not within 5 graduations on either side of "zero", adjust either CAL A or CAL B as required.

12. Reverse setting of each polarity switch and repeat steps 8 and 9.

13. For tracking, place the middle size gage block beneath the contacts of both gage heads and re-check the "zero" reading. Adjust Electrical Zeroing, if necessary. Substitute as many intermediate sizes of gage blocks as desired to determine the response at various points throughout the ±.010" range.

The meter hand should not deviate more than 5 graduations on analog meters, or ±2 counts on digital meters, indicating that tracking accuracy is correct.

If the deviation is greater at any point, repeat the procedure to make sure that it has been accomplished correctly. If deviation persists, amplifier and gage heads should be returned to the factory for service.

Note: The above procedure applies to gage heads having equal outputs.

Section 4. RS-232C Communications

You can change the "432" digital amplifier's communication protocol by reselecting an internal switch (SW1) and thereby make the amplifier output compatible with various printers and computers. A label inside the top cover (reproduced below) shows how to set SW1's DIP switches.

SW5	SW6	Baud Rate	SW1			
CL	CL	1200	SW	OPEN	CLOSED	COMMENT
OP	CL	2400	1	INCH	METRIC	STD FORMAT
CL	OP	4800	2	OFF	ON	PARITY
OP	OP	9600	3	EVEN	ODD	PARITY
			4	COMPUTER	PRINTER	MODE
			5 6	SEE CHART BELOW		BAUD RATE SELECTION
			7	1 BIT	2 BITS	STOP BITS
			8	OFF	ON	CONTINUOUS OUTPUT

DANGER SHOCK HAZARD. Unplug unit before taking cover off.

SW1 can be accessed by removing the amplifier's top cover. Note the 2 PC boards directly behind the digital meter; the rear one is the communication board (if present) and carries SW1 in its upper corner. SW1's DIP switches are "opened" by pressing down with a pen on the side of switch marked OPEN.

	DIP	OPEN	CLOSED	COMMENT
Selects output in correct measuring convention See DIP 2.	1	INCH	METRIC	STD FORMAT
Selects parity ON-OFF	2	OFF	ON	PARITY
Selects parity EVEN-ODD	3	EVEN	ODD	PARITY
Selects mode. Make mode and parity comply with computer or printer manufacturer's specs. OPEN sends display value without decimal point. CLOSED sends value with decimal point dependent on inch/metric selection.	4	COMPUTER	PRINTER	MODE

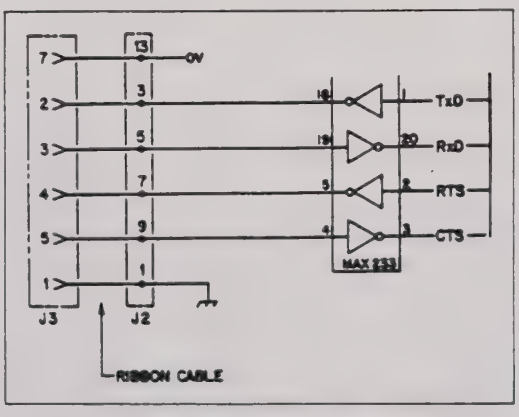
	DIP	OPEN	CLOSED	COMMENT
DIP 5 and 6 are used together to select transmission rate. See below.	5 6	AS SHOWN BELOW.		BAUD RATE SELECTION
Selects 1 or 2 stop bits.	7	1 BIT	2 BITS	
Selects output: continuous (ON) or requires handshake signals (OFF).	8	OFF	ON	

SW5	SW6	BAUD RATE	COMMENT
CL	CL	1200	The combination of SW5 and SW6 CLOSED sets transmission at 1200 baud rate.
OP	CL	2400	OPEN and CLOSE these switches as shown to vary transmission rates.
CL	OP	4800	
OP	OP	9600	

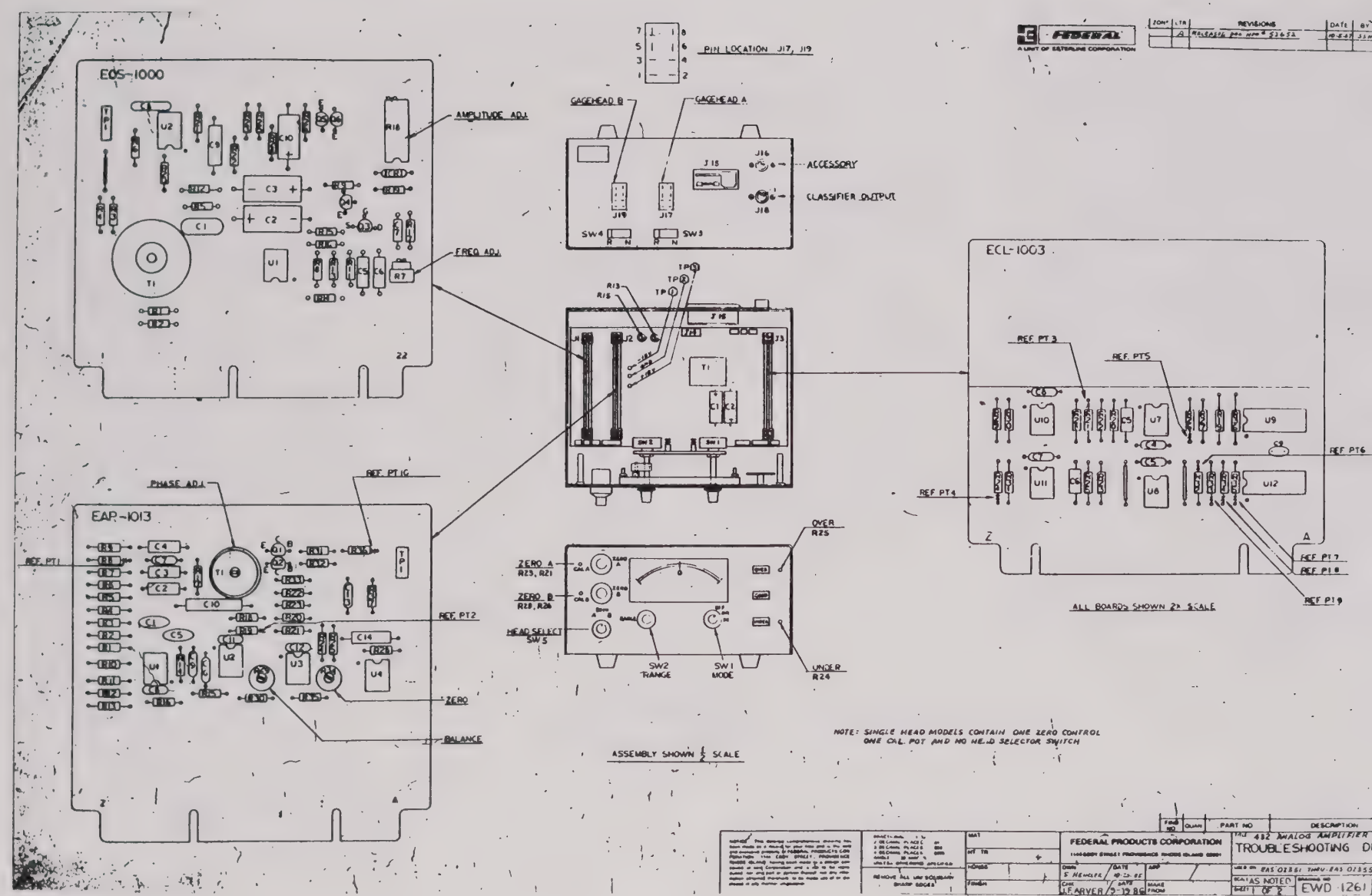
Unless otherwise specified, the factory settings are as follows:

1	2	3	4	5	6	7	8
OP	OP	OP	OP	CL	CL	CL	CL

Once all settings have been made, cover replaced and power restored, start data transmission in one of three ways; (1) An optional thumbbutton transmits value on display once for each time pressed. (2) Your computer can RS-232 to transmit an ASCII question mark, "?"; amplifier transmits a signal reading each time. (3) To begin a sampling output consisting of 2.5 display values per second, send an ASCII open parentheses, "(". to terminate sampling, transmit over RS-232 a close parentheses ")".



RS-232 Pin Out


EOS-1000
AMPLITUDE ADJ.
FREQ ADJ.
PIN LOCATION J17, J19
GAGEHEAD B
GAGEHEAD A
J16
ACCESSORY
J15
CLASSIFIER OUTPUT
J18
J19
J17
SW4
SW3
ECL-1003
REF PT 3
REF PT5
REF PT6
REF PT4
REF PT 7
REF PT 8
REF PT 9
ALL BOARDS SHOWN 2X SCALE
EAP-1013
PHASE ADJ.
REF PT 16
REF PT1
REF PT2
ZERO
BALANCE
ZERO A
R23, R21
ZERO B
R22, R26
HEAD SELECT
SW 5
OVER
R25
UNDER
R24
SW2
RANGE
SW1
MODE
ASSEMBLY SHOWN 1/2 SCALE
NOTE: SINGLE HEAD MODELS CONTAIN ONE ZERO CONTROL
ONE CAL POT AND NO HEAD SELECTOR SWITCH
FEDERAL
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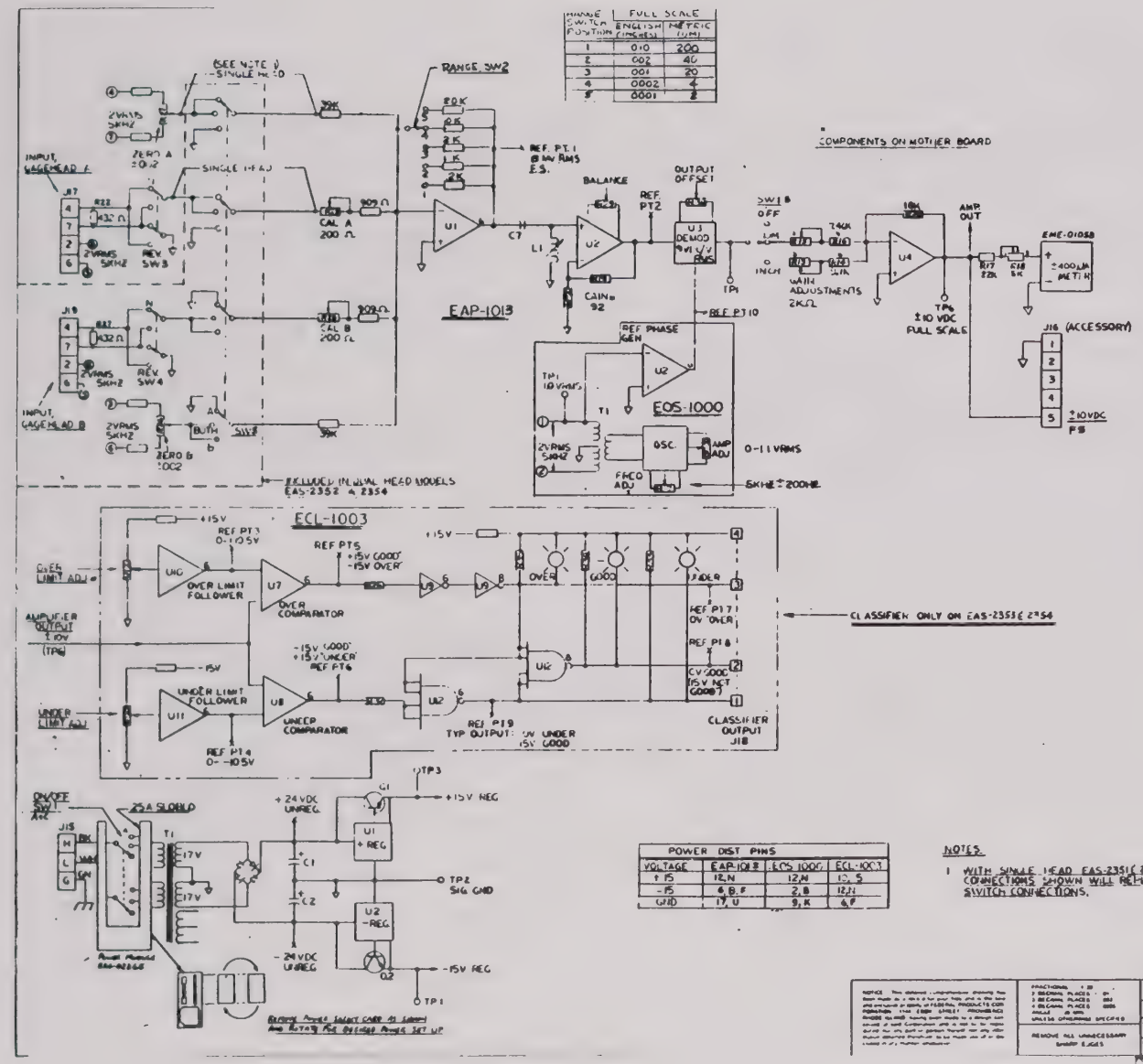
REVISIONS
FEDERAL PRODUCTS CORPORATION
TROUBLESHOOTING
EWD 1261



RANGE SWITCH POSITION	FULL SCALE ENGLISH (INCHES)	FULL SCALE METRIC (MM)
1	010	200
2	002	40
3	001	20
4	0002	4
5	0001	2

MONITOR POINT RELATIVE TO GND (TP4)	WAVEFORM NOMINAL VALUES GIVEN ARE FOR ENGLISH SYSTEM UNLESS SPECIFIED	COMMENTS, RELATIVE ADJUSTMENTS (ALL NORM/REV SWITCHES IN "NORM")
EXCITATION OSC. TP1 ON OSC CARD	0V	LEVEL R18 1 VRMS FREQ. R7 5KHZ
R30 ON AMP CARD	+12V, 0V, -12V	REF SQ WAVE
GAGEHEAD OUTPUT HEAD A: J17 PIN 4 HEAD B: J19 PIN 4	0.	4 MVRMS/.001 GAGEHEAD DISPLACEMENT. IN PHASE WITH OSC. TP1 = POS. OUTPUT. OUT OF PHASE = NEG. OUTPUT
REF PT1 AMP CARD (R18)	0V	8 MVRMS = 10VDC AT TP6
REF PT2 AMP CARD R19	0V	735 MVRMS = 10VDC AT TP6. ADJUST L1 TO BRING WAVEFORM AT REF PT2 IN PHASE WITH OSC. AT TP1.
DEMOD OUTPUT TP1 ON AMP	0V, 10.4V	10.4V = 10VDC AT TP6. ADJ R29 TO BALANCE AMPLITUDE OF ALTERNATE PEAKS
AMP OUTPUT J16 PIN 1	PINS +10 V, PIN 1 0V	± 10V F.S. R34 ADJUSTS OUTPUT TO ZERO VOLTS WITH NO GAGEHEAD INPUT & A NULL AT REF PT2. R13 (BIS METRIC) ADJ OUTPUT TO 10 WITH CAL ADJ IN CENTER OF TRAVEL.

POWER DIST PINS			
VOLTAGE	EAP-1013	EOS 1000	ECL-1003
+15	12,N	12,N	10, S
-15	6, B, F	2, B	12,N
GND	17, U	9, K	6, P

NOTES

1 WITH SINGLE HEAD EAS-2351 & 2353 BOTH DIRECT CONNECTIONS SHOWN WILL REPLACE SWITCH CONNECTIONS.

ZONE	LTR	REVISIONS	DATE	BY
		SEE SHEET #1 FOR REVISIONS		

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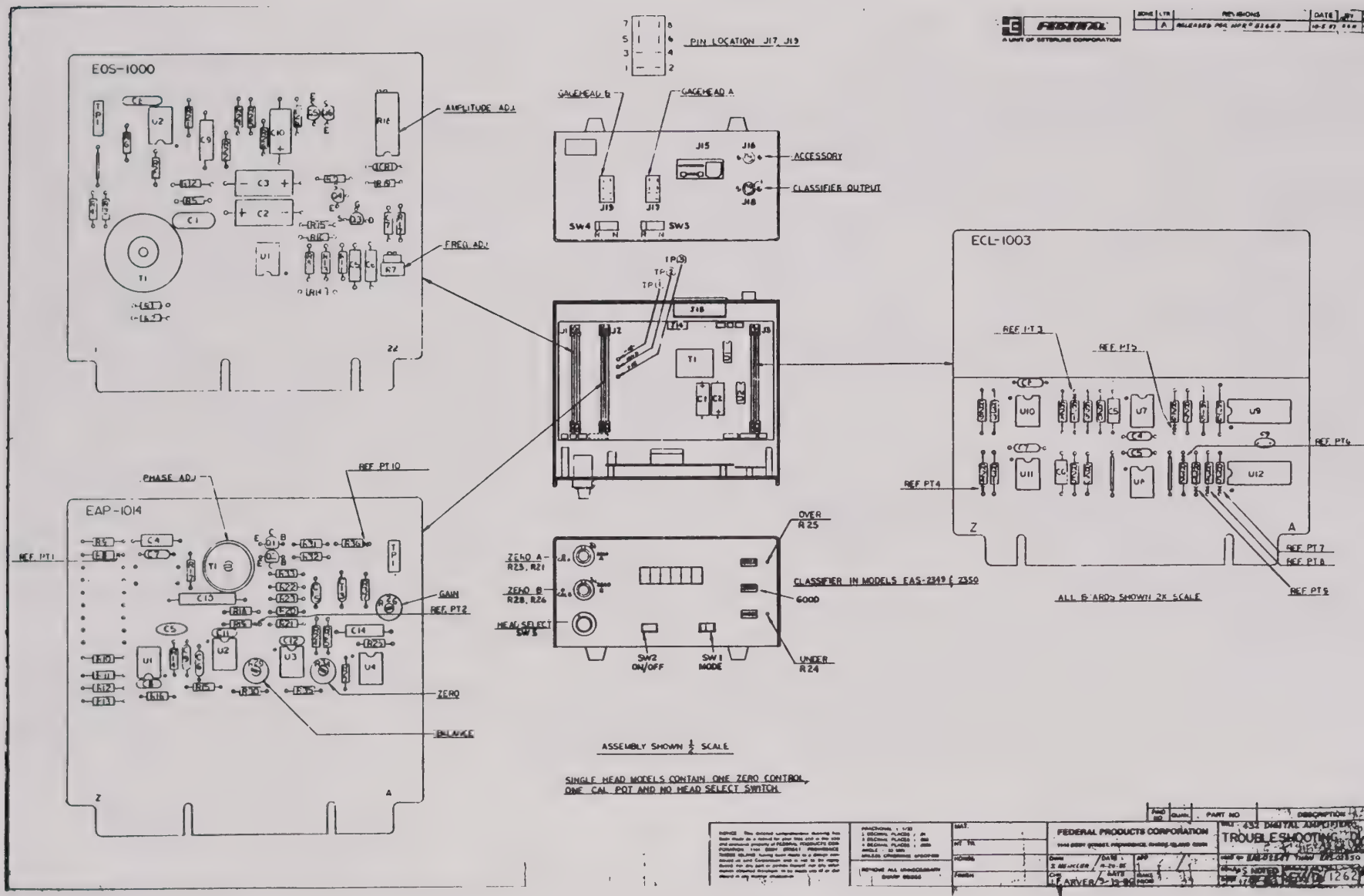
A UNIT OF ESTERLINE CORPORATION

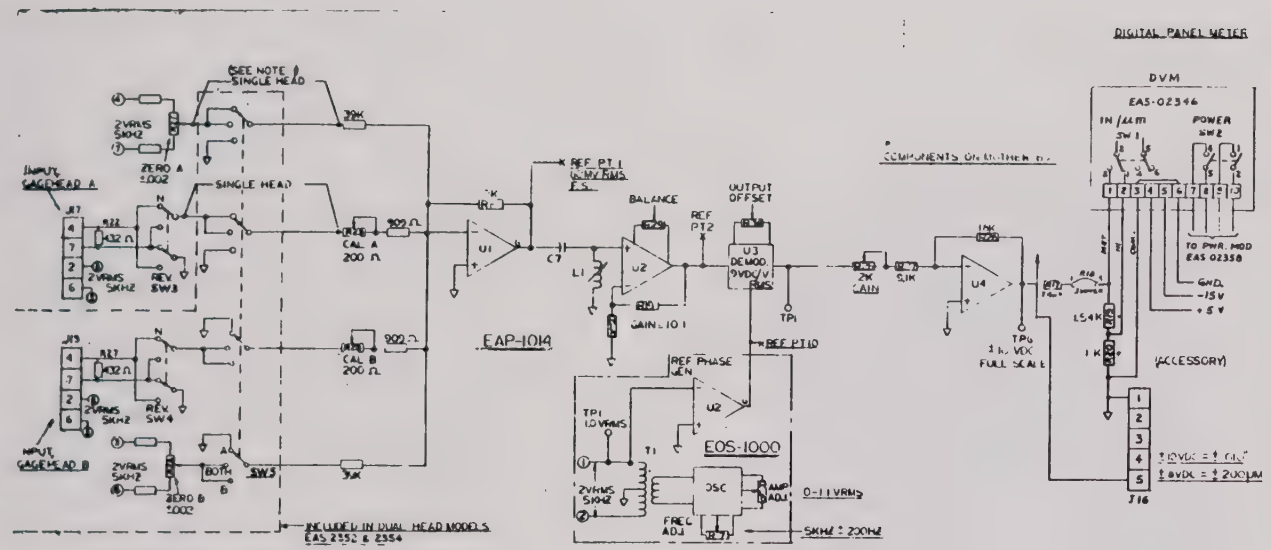
FIND NO	QUAN	PART NO	DESCRIPTION

FEDERAL PRODUCTS CORPORATION
1144 EDDY STREET PROVIDENCE RHODE ISLAND 02905

SIZE 432 ANALOG AMPLIFIER
TROUBLESHOOTING DIAG

DRAWN B. HERMANSEN DATE 10-20-82
CHK'D J. CARVER 3-13-86
APP
USED ON EAS-0838I THRU EAS-0838S
SCALE
SHEET 2 OF 2
DRAWING NO EWD-1261


EOS-1000
AMPLITUDE ADJ
FREQ ADJ
PIN LOCATION J17, J19
GAGEHEAD B
GAGEHEAD A
J15
J16
ACCESSORY
CLASSIFIER OUTPUT
J18
J19
J17
SW4
SW3
ECL-1003
REF PT 3
REF PT 2
REF PT 6
REF PT 4
REF PT 7
REF PT 8
REF PT 5
ALL BOARDS SHOWN 2X SCALE
PHASE ADJ
REF PT 10
EAP-1014
REF PT 1
GAIN
REF PT 2
ZERO
BALANCE
ZERO A - R23, R21
ZERO B R28, R26
HEAD SELECT SW3
SW2 ON/OFF
SW1 MODE
OVER R25
6000
UNDER R24
CLASSIFIER IN MODELS EAS-2349 & 2350
ASSEMBLY SHOWN 1/2 SCALE
SINGLE HEAD MODELS CONTAIN ONE ZERO CONTROL, ONE CAL POT AND NO HEAD SELECT SWITCH
FEDERAL PRODUCTS CORPORATION
TROUBLESHOOTING DIAGRAM
433 DIGITAL AMPLIFIERS



MONITOR POINT RELATIVE TO GND (TP4)	WAVEFORM – NOMINAL VALUES GIVEN ARE FOR ENGLISH SYSTEM UNLESS SPECIFIED	COMMENTS/RELATIVE ADJUSTMENT (ALL NORM/REV. SWITCHES IN "NORM")
EXCITATION OSC. TP1 ON OSC CARD	0V	LEVEL ADJ. 1 VRMS FREQ ADJ. 5KHz
R36 ON AMP	+12V 0V -12V	REF SQ. WAVE
GAGEHEAD OUTPUT HEAD A J17 PIN 4 HEAD B J19 PIN 4	1V	4 MVRMS/.001 GAGEHEAD DISPLACEMENT IN PHASE WITH OSC TP1 = POS. OUTPUT OUT OF PHASE = NEG. OUTPUT.
REF PT 1 AMP CARD R19	0V	60 MVRMS = 10VDC AT TP6
REF PT 2 OSC CARD R101	0V	600 MVRMS = 10VDC AT TP6. ADJUST L1 TO BRING WAVEFORM AT REF PT 2 IN PHASE WITH OSC. AT TP1.
DEMOD OUTPUT TP1 ON AMP	0V 1V	1VP P = 10VDC AT TP6. ADJ. R29 TO BALANCE AMPLITUDE OF ALTERNATE PEAKS
DIG. OUTPUT J16 (PINS 1 TO 4) (PIN 5)	+10V 0V	± 10V F.S. R34 ADJUSTS OUTPUT TO ZERO VOLTS WITH NO GAGEHEAD INPUT A NULL AT REF PT 2. R26 ADJ. OUTPUT TO 0 WITH "CAL ADJ" IN CENTER OF TRAVEL.

POWER DIST. PINS			
VOLTAGE	EAP-1014	EOS-1000	ECL-1003
+15	12, N	12 N	10, 5
-15	6, B, F	2 B	12, N
GND	17, U	9 K	6, F

NOTE:

1. WITH SINGLE HEAD EAS 2347 & 2349 BOTH DIRECT CONNECTIONS SHOWN WILL BE PLACE SWITCH CONNECTIONS.

FEDERAL PRODUCTS CORPORATION
1601 EDDY STREET PROVIDENCE, RHODE ISLAND 02901

TITLE: 432 DIGITAL AMPLIFIER TROUBLESHOOTING DIA

DRWN: J. MUELLER 11-20-85
CHKD: CARVER 3-19-86
APP'D:
MFG: FROM:

DWG NO. EAS-02347 THRU EAS-02350
SCALE: NONE
SHEET 2 OF 2
REV
EWD-1262

A-866 17606

Printed in U.S.A.

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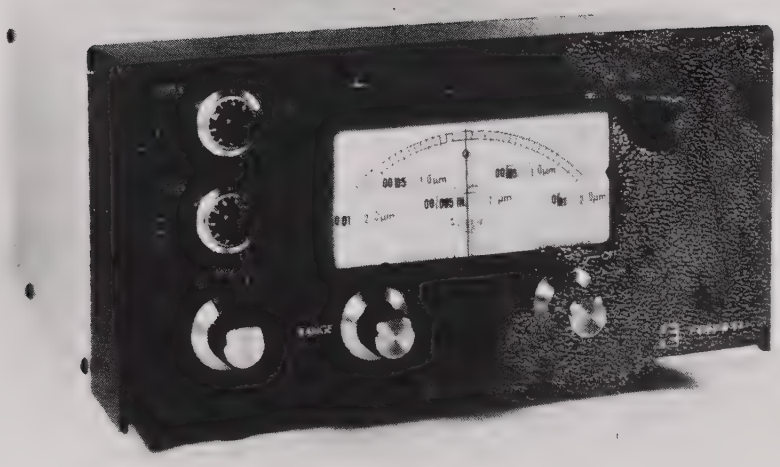

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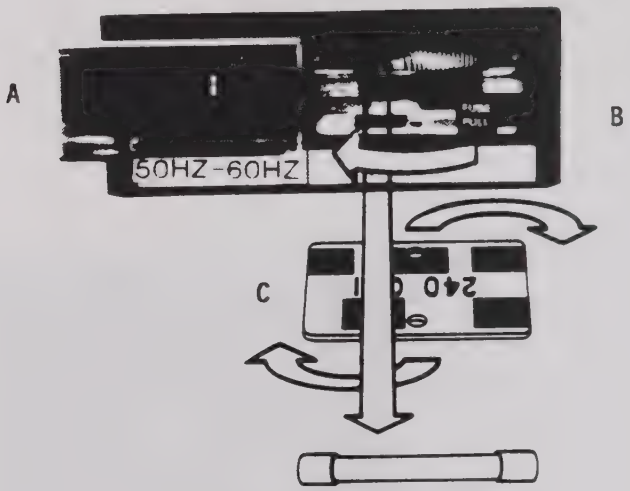


A. Remove Power Cable and slide clear cover over to left.

B. Draw fuse extractor to left and remove fuse.

C. Slide out circuit board and rotate until desired voltage is shown on left side.

Replace circuit board and fuse. Slide clear cover to right and re-connect power cable.

Push Power Switch on Rear Panel to the "On" position.

Section 2. Setup

Tolerance Limits

Four models are equipped with adjustable limits which cause red, green and yellow limit lights to function. With Amplifier on, set limits as follows:

1. If maximum limit spread is within ±.0025", you can unplug the gage head(s) involved and set the meter to each limit using the Zero Knob. If limit spread exceeds ±.0025", you will need to displace the gage head contact enough so that the limit you are setting is within Zero Knob range. Using appropriate method, set meter to read exact low tolerance limit value, for example, -.00025".

2. Use a small screwdriver to adjust the potentiometer, located to the the right of the UNDER light, until the light goes out and the GOOD light comes on. Check setting by moving meter reading back slightly towards "zero", then slowly towards -.00025". As the meter passes .00025", UNDER light should come on. Fine tune potentiometer if necessary.

3. Use Zero Knob to make meter read exact upper tolerance limit, for example, +.00025". Repeat procedure in step 2, except use OVER limit potentiometer to make OVER light go on when meter reading exceeds +.00025".

Series "432" Amplifiers
Rear Panel

Single Head Gaging

1. Plug gage head connector into receptacle on rear of amplifier.

2. Set amplifier controls:

Zero control at mid-range (#5 in the window).
Range switch (analog models only) to desired range.
Head selector to letter of head being set (dual-head models only).
Inch-Metric switch to appropriate system
Off-On Switch to On
Normal/Reverse switch (above gage head receptacle) to position that gives plus reading when dimension being checked increases. (set both switches on dual-head models).

3. Put a nominal (mean size) master in gaging position. The meter should read within ±.001" of "zero". If it does not, loosen gage head mounting and move the gage head in or out until meter reads ±.001" of "zero", with gage head mounting locked up.

4. Use Zero Contol to make meter read exact "zero" (or exact known deviaton of the master from nominal size).

Dual Head Gaging - Differential Mode

The dual head amplfiers can integrate the outputs from two gage heads and display the algebraic sum of the two signals as a single reading. This mode is commonly used for gaging a diameter (or thickness) not positively located in space.

1. With gage heads removed, set both Zero Controls to mid-range.

2. Connect both gage heads to their respective sockets at the rear of the amplifier.

3. Put both gage head polarity switches, "A" and "B", in the "Normal" position. This will provide "plus" input.

4. Place the gage head Selection Switch in the "A" position.

5. Using a setting master or qualified workpiece, position gage head "A" to produce a reading within ±.001" of "zero". Then lock the gage head in this position.

6. Place the gage head select switch in "Both" position.

7. Adjust the position of gage head "B" until the meter again reads within ±.001" of "zero". Then, lock the gage head in this position. Use either Zero control to bring meter reading to exact "zero".

As the part is rotated during gaging, any lack of concentricity between the large and small diameters is cancelled by equal but opposite output from the gage heads and a true reading of diameter is presented.

To obtain an indication of eccentricity, place the gage head selection switch in the "A" position. Now the reading will be the radial runout at gage head "A". The same can be done with gage head "B".

Note: Sometimes the part's shape or the gaging fixture design requires a means of contacting the part with something such as a lever which reverses the direction of the gage head action. Then, variations in size etc. can be displayed in the normal direction by placing both gage head input switches in the reverse position. This will provide a "minus" input.

Dual Head Gaging - Angle Conformity or Rate-of-Taper Mode

1. With gage heads removed, set both Zero Controls to mid-range.

2. Connect both gage heads to the amplifier.

3. Put the Gage Head Polarity Switch for Head "A" in the Normal position for "plus" input. Put the switch for Head "B" in the Reverse Position for "minus" input.

4. Place the Gage Head Select Switch on "A".

5. Using a master or qualified workpiece, position gage head "A" to produce a reading within ± .001" of "zero". Then, lock gage head in this position. Use "A" Zero Control to position meter exatly on "zero".

6. Place the Gage Head Select Switch in the BOTH position.

7. Adjust the position of gage head "B" until the reading is again within ±.001" of "zero". Then lock the gage head in this position. Use either Zero Control to set the meter exactly on "zero".

Changes in taper will be shown. Variations in size that do not affect taper are cancelled out.

Section 3. Calibration

On analog models, with power off, check alignment of hand with dial "zero". If not exactly on "zero", adjust screw in line with pivot point of hand until alignment is exactly on "zero".

Turn power on and allow the amplifier to be in operation for a reasonable amount of time for complete stabilization.

Single Head Models

1. Secure the gage head in suitable fixture. Set the amplifier controls as follows:

Mode Switch	Inch
Scale Selector Switch (analog meters only)	Longest Range
Polarity Switch (on back panel)	Norm.
Electrical Zeroing Control	No. 5 in window

2. Select three gage blocks which differ in size by .010". Place the middle size block in position and adjust the position of gage head "B" mechanically so that the meter reads as closely as possible to "zero". Adjust Electrical Zeroing, if necessary, to achieve precise alignment. Remove and reposition gage block to check for proper repeat reading.

3. Substitute the +.010" gage block and observe any deviation from a +.010" reading on the meter. If there is a deviation, use CAL Screw to reduce the deviation by 1/2 its value.

4. Substitute the -.010" gage block and observe any deviation from -.010" reading. If there is one, use Zero potentiometer to reduce the deviation by 1/2 its value.

5. Repeat steps 3 and 4 until end of range errors are 4/5 graduation or less on analog meters or ±1 count of least digit on digital meters.

6. Substitute the "zero" gage block and observe any deviation from an exact "zero" reading. If reading is more than 4/5 a graduation on analog meter, or more than ±1 count of least digit on digital display, reset meter to "zero" with Zero Potentiometer and repeat steps 3, 4 and 6.

7. Set the Polarity Switch in the Reverse position. Fine tune "zero" setting with Zero Knob (if necessary)

and repeat steps 2 and 3, except do NOT adjust CAL Screw or Zero Knob. Each reading should match the reading obtained in step 3 within the calibration accuracy, but at the opposite ends of the scale.

Dual Head Models

The checking and adjustment of these amplifiers and the balancing of gage head outputs can be performed in one series of operations. It requires a fixturing setup that permits the contacts of both gage heads to engage the same gage block simultaneously. Point of contact should be as close together as possible.

1. Set the amplifier control as follows:*

Mode Switch	Inch
Scale Selector Switch (analog meters only)	Longest Range
Polarity Switches (on back panel)	Norm.
Electrical Zeroing Controls	No. 5 in window
Gage Head Selector Switch	"B"

*Note: Be sure <u>both</u> Polarity Switches and <u>both</u> Electrical Zeroing Controls are set as stated.

2. Select three gage blocks which differ in size by .010". Place the middle size block in position and adjust gage head "B" mechanically so that the meter reads as closely as possible to "zero". Adjust the electrical Zeroing Control for Gage Head "B" if necessary, to achieve precise alignment. Remove the gage block and reinsert to check for the proper repeat reading.

3. Substitute the +.010" gage block and observe any deviation from +.010" reading on the meter. If there is a deviation, use CAL B screw to reduce the deviation by 1/2 its value.

4. Substitute the -.010" gage block and observe any deviation from a -.010" reading. If there is one, use Zero B potentiometer to reduce the deviation by 1/2 its value.

5. Repeat steps 3 and 4 until end-of-range errors are 4/5 graduation or less on analog meters or ±1 count of least digit on digital meters.

6. Substitute the "zero" gage block and observe any deviation from an exact "zero" reading. If reading is more than 4/5 a graduation on analog meter, or more

than ±1 count of least digit on digital meter, reset meter to "zero" with Zero Potentiometer and repeat steps 3, 4 and 6.

7. Reverse "B" Head polarity switch, fine tune "zero" setting with Zero Knob (if necessary) and repeat steps 2, 3 and 4, except do not make any adjustments. Readings should be same as they were at end of step 6 except with "plus" and "minus" at opposite sides of "zero".

8. Place gage head "A" in position. Turn Selector Switch to the "A" position and make adjustments as in Step 2.

9. Follow the same procedure as in Steps 2 through 7 except use CAL A and Zero A Potentiometers.

10. Turn the Range Selector Switch to the shortest range and use the Electrical Zeroing Controls to set meter precisely to "zero" as the Head Selector Switch is placed alternately in the "A" and "B" position.

11. For balancing, set one polarity switch to NORMAL and one to REVERSE. Check "zero" setting for each head and fine tune, if necessary. Then turn the Head Selector Switch to the BOTH position. The Scale Selector Switch should be set on the shortest range. Place the +.010" gage block beneath the contacts of both gage heads. The meter should read within 5 graduations of "zero" for analog meters or ±2 counts of least digit on digital meters. A similar reading should be obtained with the -.010" gage block in place. This indicates a balancing accuracy to within 0.25% at maximum displacement. If the balancing accuracy is not within 5 graduations on either side of "zero", adjust either CAL A or CAL B as required.

12. Reverse setting of each polarity switch and repeat steps 8 and 9.

13. For tracking, place the middle size gage block beneath the contacts of both gage heads and re-check the "zero" reading. Adjust Electrical Zeroing, if necessary. Substitute as many intermediate sizes of gage blocks as desired to determine the response at various points throughout the ±.010" range.

The meter hand should not deviate more than 5 graduations on analog meters, or ±2 counts on digital meters, indicating that tracking accuracy is correct.

If the deviation is greater at any point, repeat the procedure to make sure that it has been accomplished correctly. If deviation persists, amplifier and gage heads should be returned to the factory for service.

Note: The above procedure applies to gage heads having equal outputs.

Section 4. RS-232C Communications

You can change the "432" digital amplifier's communication protocol by reselecting an internal switch (SW1) and thereby make the amplifier output compatible with various printers and computers. A label inside the top cover (reproduced below) shows how to set SW1's DIP switches.

SW5	SW6	Baud Rate	SW1			
CL	CL	1200	SW	OPEN	CLOSED	COMMENT
OP	CL	2400	1	INCH	METRIC	STD FORMAT
CL	OP	4800	2	OFF	ON	PARITY
OP	OP	9600	3	EVEN	ODD	PARITY
			4	COMPUTER	PRINTER	MODE
			5 6	SEE CHART BELOW		BAUD RATE SELECTION
			7	1 BIT	2 BITS	STOP BITS
			8	OFF	ON	CONTINUOUS OUTPUT

DANGER SHOCK HAZARD. Unplug unit before taking cover off.

SW1 can be accessed by removing the amplifier's top cover. Note the 2 PC boards directly behind the digital meter; the rear one is the communication board (if present) and carries SW1 in its upper corner. SW1's DIP switches are "opened" by pressing down with a pen on the side of switch marked OPEN.

	DIP	OPEN	CLOSED	COMMENT
Selects output in correct measuring convention See DIP 2.	1	INCH	METRIC	STD FORMAT
Selects parity ON-OFF	2	OFF	ON	PARITY
Selects parity EVEN-ODD	3	EVEN	ODD	PARITY
Selects mode. Make mode and parity comply with computer or printer manufacturer's specs. OPEN sends display value without decimal point. CLOSED sends value with decimal point dependent on inch/metric selection.	4	COMPUTER	PRINTER	MODE

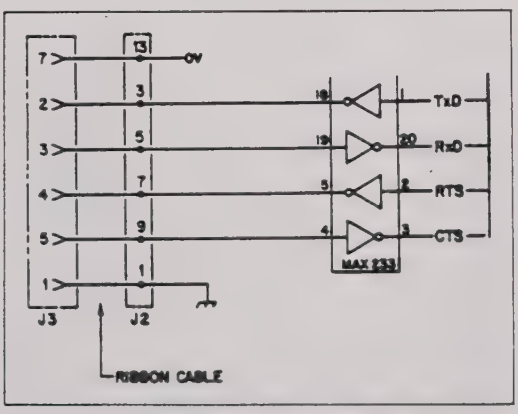
	DIP	OPEN	CLOSED	COMMENT
DIP 5 and 6 are used together to select transmission rate. See below.	5 6	AS SHOWN BELOW.		BAUD RATE SELECTION
Selects 1 or 2 stop bits.	7	1 BIT	2 BITS	
Selects output: continuous (ON) or requires handshake signals (OFF).	8	OFF	ON	

SW5	SW6	BAUD RATE	COMMENT
CL	CL	1200	The combination of SW5 and SW6 CLOSED sets transmission at 1200 baud rate.
OP	CL	2400	OPEN and CLOSE these switches as shown to vary transmission rates.
CL	OP	4800	
OP	OP	9600	

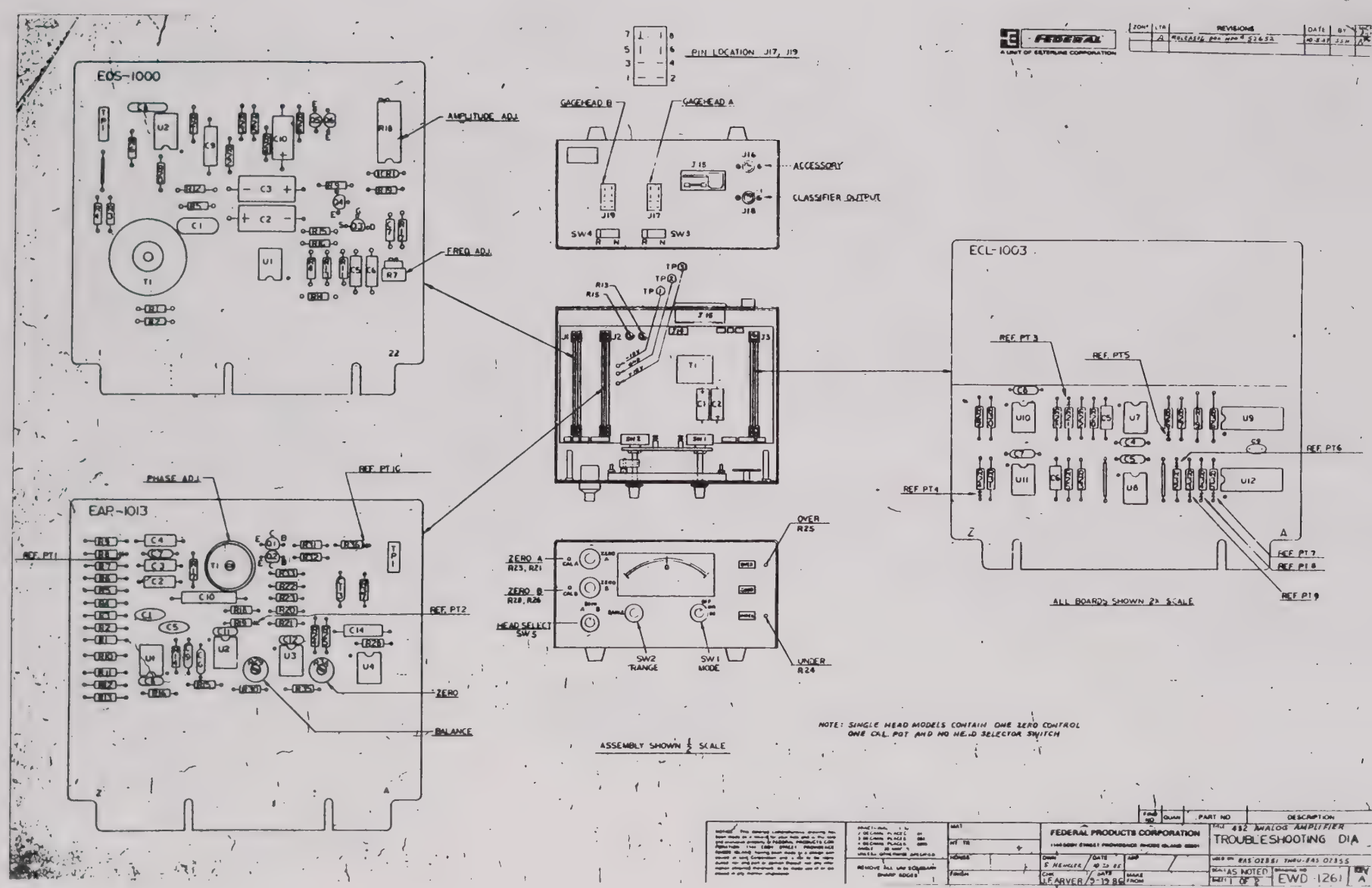
Unless otherwise specified, the factory settings are as follows:

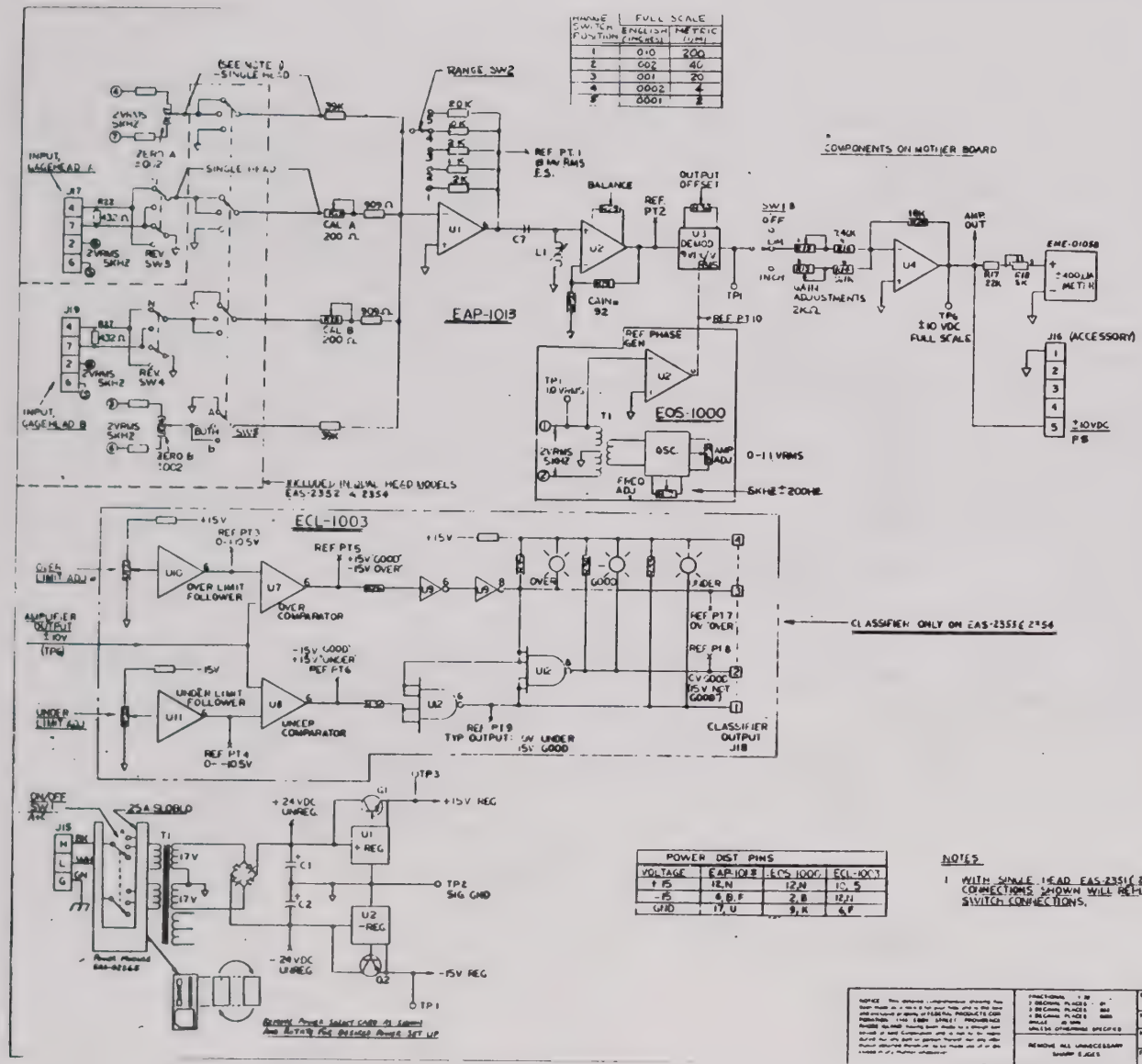
1	2	3	4	5	6	7	8
OP	OP	OP	OP	CL	CL	CL	CL

Once all settings have been made, cover replaced and power restored, start data transmission in one of three ways; (1) An optional thumbbutton transmits value on display once for each time pressed. (2) Your computer can RS-232 to transmit an ASCII question mark, "?"; amplifier transmits a signal reading each time. (3) To begin a sampling output consisting of 2.5 display values per second, send an ASCII open parentheses, "(". to terminate sampling, transmit over RS-232 a close parentheses ")".



RS-232 Pin Out


EOS-1000
AMPLITUDE ADJ.
FREQ ADJ.
PIN LOCATION J17, J19
GAGEHEAD B
GAGEHEAD A
ACCESSORY
CLASSIFIER OUTPUT
SW4
SW3
ECL-1003
REF PT 3
REF PT5
REF PT6
REF PT4
REF PT 7
REF PT 8
REF PT 9
ALL BOARDS SHOWN 2× SCALE
EAR-1013
PHASE ADJ.
REF PT1G
REF PT1
REF PT2
ZERO
BALANCE
ZERO A R23, R21
ZERO B R28, R26
HEAD SELECT SW5
OVER R25
UNDER R24
SW2 RANGE
SW1 MODE
ASSEMBLY SHOWN 1/2 SCALE
NOTE: SINGLE HEAD MODELS CONTAIN ONE ZERO CONTROL ONE CAL POT AND NO HEAD SELECTOR SWITCH
FEDERAL PRODUCTS CORPORATION
PART NO
DESCRIPTION
432 ANALOG AMPLIFIER
TROUBLESHOOTING DIA
AS NOTED
EWD-1261
A



PHASE SWITCH POSITION	FULL SCALE ENGLISH (INCHES)	FULL SCALE METRIC (MM)
1	010	200
2	002	40
3	001	20
4	0002	4
5	0001	2

POWER DIST PINS			
VOLTAGE	EAP-1013	EOS-1000	ECL-1003
+15	12,N	12,N	10,5
-15	6,B,F	2,8	12,11
GND	17,U	9,K	6,F

NOTES

1 WITH SINGLE HEAD EAS-2351 & 2353 BOTH DIRECT CONNECTIONS SHOWN WILL REPLACE SWITCH CONNECTIONS.

MONITOR POINT RELATIVE TO GND (TP4)	WAVEFORM NOMINAL VALUES GIVEN ARE FOR ENGLISH SYSTEM UNLESS SPECIFIED	COMMENTS, RELATIVE ADJUSTMENTS (ALL NORM/REV SWITCHES IN "NORM")
EXCITATION OSC. TP1 OF OSC CARD	0V	LEVEL R18 1 VRMS FREQ N7 5KHZ
R30 OR J18	+12V 0V -12V	REF SQ WAVE
GAGEHEAD OUTPUT -E:D A: J17 PIN 4 HEAD B: J19 PIN 4	0.	4 MVRMS/.001 GAGEHEAD DISPLACEMENT IN PHASE WITH OSC TP1 = POS OUTPUT OUT OF PHASE = NEG OUTPUT.
REF PT1 AMP CARD (R8)	0V	8 MVRMS = 10VDC AT TP6
REF PT2 AMP CARD R15B		735 MVRMS = 10VDC AT TP6 ADJUST L1 TO BRING WAVEFORM AT REF PT2 IN PHASE WITH OSC AT TP1.
DEMOD OUTPUT TP1 OR AMP	0V 10.4V	10.6V = 10VDC AT TP6 ADJ R29 TO BALANCE AMPLITUDE OF ALTERNATE PEAKS
AMP OUTPUT J16 PINS +10 V PIN 1 0V		± 10V F.S. R34 ADJUSTS OUTPUT TO ZERO VOLTS WITH NO GAGEHEAD INPUT & A NULL AT REF PT 2. R13 (R15 METRIC) ADJ OUTPUT TO 10 WITH "CAL ADJ" IN CENTER OF TRAVEL.

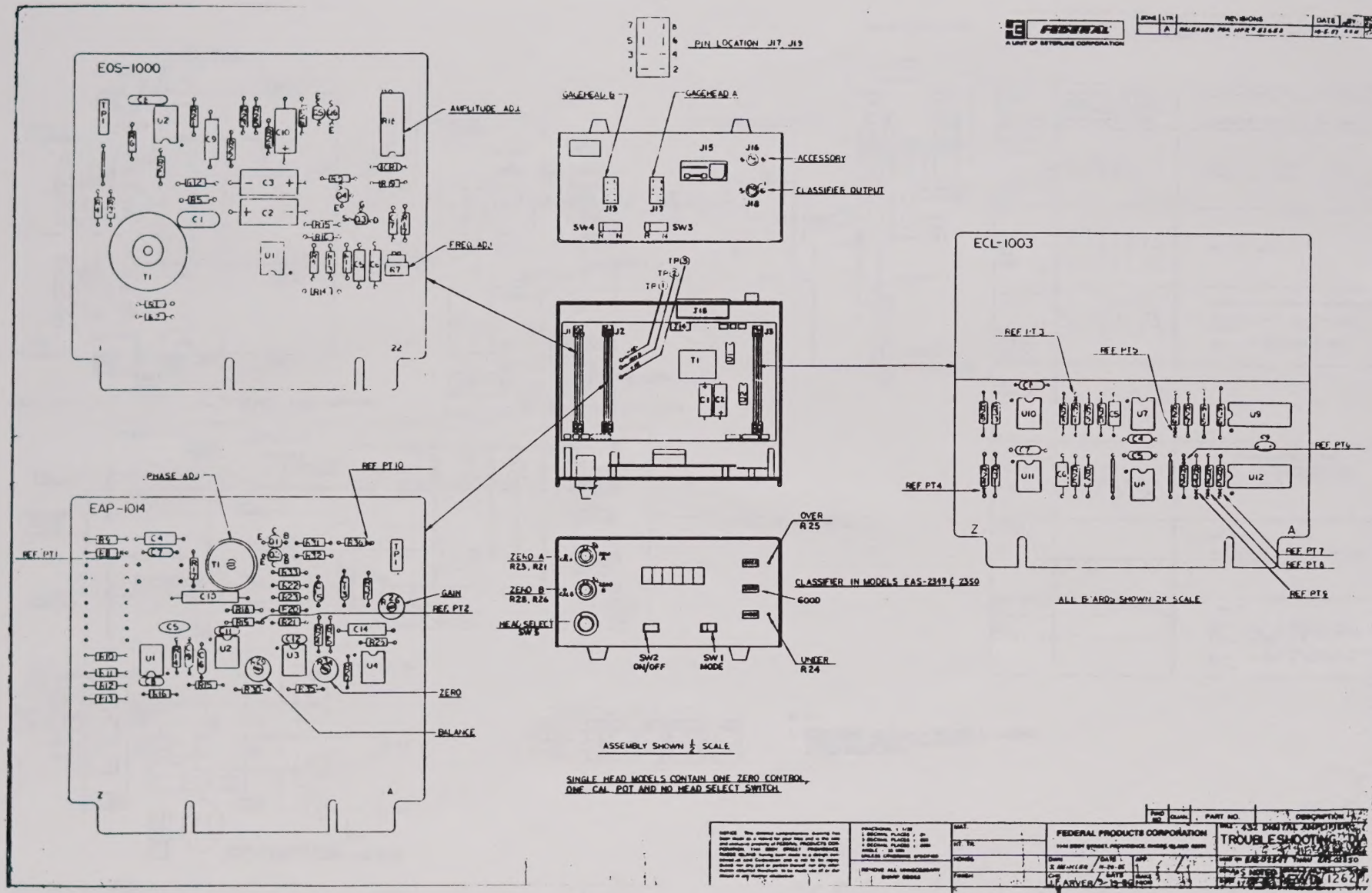
FEDERAL PRODUCTS CORPORATION
PROVIDENCE, RHODE ISLAND

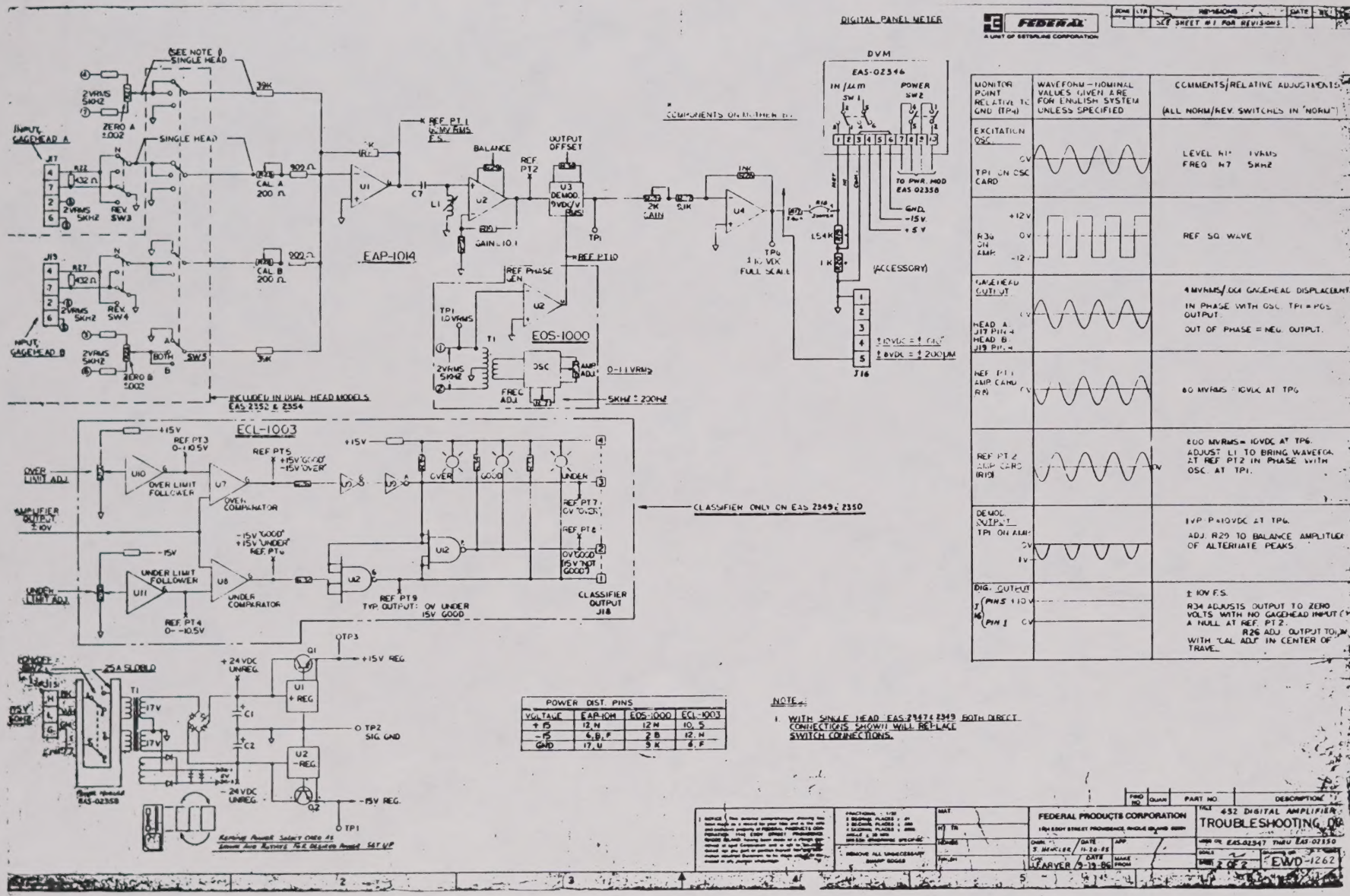
PART NO — DESCRIPTION
432 ANALOG AMPLIFIER TROUBLESHOOTING DIAG

USED ON EAS-02881 THRU EAS-02355

SIZE D | DRAWING NO EWD-1261 | SHEET 2 OF 2

DRAWN R. ABRAHAMS 8-16-85
CHK J. CARVER 9-19-85


EOS-1000
AMPLITUDE ADJ
FREQ ADJ
PIN LOCATION J17, J19
GAGEHEAD B
GAGEHEAD A
J15
J16
ACCESSORY
CLASSIFIER OUTPUT
J18
J19
J17
SW4
SW3
TP(3)
TP(2)
TP(1)
ECL-1003
REF PT 3
REF PT 5
REF PT 4
REF PT 6
REF PT 7
REF PT 8
REF PT 9
EAP-1014
PHASE ADJ
REF PT 10
REF PT 1
GAIN
REF PT 2
ZERO
BALANCE
ZERO A - R23, R21
ZERO B - R28, R26
HEAD SELECT SW5
OVER A25
CLASSIFIER IN MODELS EAS-2349 & 2350
6000
UNDER A24
SW2 ON/OFF
SW1 MODE
ALL BOARDS SHOWN 2X SCALE
ASSEMBLY SHOWN ½ SCALE
SINGLE HEAD MODELS CONTAIN ONE ZERO CONTROL, ONE CAL POT AND NO HEAD SELECT SWITCH.
FEDERAL PRODUCTS CORPORATION
TROUBLESHOOTING DIA
REV 1262


DIGITAL PANEL METER
FEDERAL
A UNIT OF GOULD INC.
REVISIONS
SEE SHEET #1 FOR REVISIONS
DVM
EAS-02346
IN/μm
POWER
SW1
SW2
TO PWR. MOD EAS 02358
GND
-15V
+5V
(ACCESSORY)
J16
INPUT GAGEHEAD A
INPUT GAGEHEAD B
SINGLE HEAD
DUAL HEAD
2VRMS 5KHZ
REV SW3
REV SW4
SW5
CAL A 200 Ω
CAL B 200 Ω
902 Ω
39K
3.3K
ZERO A ±.002
ZERO B ±.002
INCLUDED IN DUAL HEAD MODELS EAS 2352 & 2354
EAP-1014
REF PT 1 6 MV RMS F.S.
BALANCE
REF PT2
OUTPUT OFFSET
U1
U2
U3 DEMOD. 9VDC/V RMS
GAIN: 10:1
TP1
REF PT10
REF PHASE GEN
EOS-1000
TP1 10 VRMS
T1
OSC
AMP ADJ.
FREQ ADJ.
0-11 VRMS
5KHZ ± 200HZ
COMPONENTS ON ANOTHER PC
2K GAIN
5.1K
1MEG
U4
TP6 1 VDC FULL SCALE
1K
ECL-1003
+15V
REF PT3 0-10.5V
REF PT5 +15V 'GOOD' -15V 'OVER'
OVER LIMIT ADJ
U10
OVER LIMIT FOLLOWER
U7
OVER COMPARATOR
AMPLIFIER OUTPUT ± 10V
-15V
UNDER LIMIT ADJ
U11
UNDER LIMIT FOLLOWER
U8
UNDER COMPARATOR
REF PT4 0- -10.5V
OVER
GOOD
UNDER
REF PT7 OV 'OVER'
REF PT6
-15V 'GOOD' +15V 'UNDER' REF PT9
OV 'GOOD' +15V 'NOT GOOD'
REF PT9 TYP. OUTPUT: OV UNDER 15V GOOD
CLASSIFIER OUTPUT J18
CLASSIFIER ONLY ON EAS 2349 & 2350
POWER CORD
25A SLOBLO
115V 50HZ
T1
17V
17V
+24 VDC UNREG.
Q1
+15V REG
U1 +REG
C1
C2
TP2 SIG GND
U2 -REG
Q2
-15V REG.
TP1
-24 VDC UNREG.
Keeping Power Supply Cord as Shown And Routed for Design Power Set Up
MONITOR POINT RELATIVE TO GND (TP4)
WAVEFORM — NOMINAL VALUES GIVEN ARE FOR ENGLISH SYSTEM UNLESS SPECIFIED
COMMENTS/RELATIVE ADJUSTMENTS (ALL NORM/REV. SWITCHES IN "NORM")
EXCITATION OSC.
TP1 ON OSC CARD
LEVEL ADJ 1VRMS
FREQ ADJ 5KHZ
R36 ON AMP
+12V
0V
-12V
REF SQ WAVE
GAGEHEAD OUTPUT
HEAD A J17 PIN 4
HEAD B J19 PIN 4
4 MVRMS/.001 GAGEHEAD DISPLACEMENT
IN PHASE WITH OSC. TP1 = POS. OUTPUT.
OUT OF PHASE = NEG. OUTPUT.
REF PT 1 AMP CARD R11
80 MVRMS = 10VDC AT TP6
REF PT 2 AMP CARD (R10)
800 MVRMS = 10VDC AT TP6.
ADJUST L1 TO BRING WAVEFORM AT REF PT 2 IN PHASE WITH OSC. AT TP1.
DEMOD. OUTPUT TP1 ON AMP
1VP P = 10VDC AT TP6.
ADJ. R29 TO BALANCE AMPLITUDE OF ALTERNATE PEAKS
DIG. OUTPUT
PINS 1 10 V
PIN 1 0V
± 10V F.S.
R34 ADJUSTS OUTPUT TO ZERO VOLTS WITH NO GAGEHEAD INPUT (A NULL AT REF. PT 2.
R26 ADJ. OUTPUT TO ±10V WITH 'CAL ADJ' IN CENTER OF TRAVEL.
POWER DIST. PINS
VOLTAGE | EAP-1014 | EOS-1000 | ECL-1003
+15 | 12, N | 12 M | 10, S
-15 | 6, B, F | 2 B | 12, M
GND | 17, U | 9 K | 8, F
NOTE:
1 WITH SINGLE HEAD EAS 2347 & 2349 BOTH DIRECT CONNECTIONS SHOWN WILL REPLACE SWITCH CONNECTIONS.
FEDERAL PRODUCTS CORPORATION
1644 EDDY STREET PROVIDENCE, RHODE ISLAND 02905
TITLE 632 DIGITAL AMPLIFIER TROUBLESHOOTING DIA
DRAWN T. MERCIER 11-20-85
CHK'D J. WEAVER 3-19-86
APP'D
MADE FROM EAS-02347 THRU EAS-02350
SCALE
SHEET 2 OF 2
DWG NO EWD-1262

A-866 17606 Printed in U.S.A.